

tallized and textured using a repetitive sequence of incremental reaction and mechanical swaging steps. During the formation of metal-ceramic composites that comprise a ceramic member possessing a thermal reaction temperature in excess of the melting temperature of the metal member to which it is bonded, it is preferred to utilize electromagnetic radiation to react and crystallize the ceramic member. In this embodiment a beam of electromagnetic radiation, characterized by an electromagnetic energy that is either in the microwave frequency spectrum or in the infrared frequency spectrum, can be directed onto the ceramic member to advance its state of crystallization. Simultaneously, the metal member, which is not irradiated by a suitably directed electromagnetic beam, can be held to a temperature well below its melting point. It is now well known to practitioners skilled in the art of microwave annealing of ceramic and other materials, that certain frequencies

**cting, or magneto-sensitive
pr perties.**

**An optional step "F" is used in which the amorphous
oxide coating 17 of article
15 is thermally reacted, or reacted by exposure to
electromagnetic radiation at
frequencies in the microwave or optical spectrum, in a
controlled gas
atmosphere to form an article 19 that comprises a fully
or partially
crystallized randomly oriented ceramic layer 21 on a
substrate 9. Any such
processing treatment that advances the state of
crystallinity in the ceramic
layer is herein referred to as a "reaction step".
Reaction steps involve the
delivery of heat to the ceramic of an amount sufficient
to activate solid-state
diffusion mechanisms and crystalline ordering in the
ceramic, which may
comprise thermal heat treatments wherein the ceramic
is exposed to an elevated
temperature, or radiation treatments wherein heat is
delivered to the ceramic
through the absorption of electromagnetic radiation.
Heat must be delivered to
the ceramic in an amount equivalent to the amount of
heat contained within the
ceramic at a crystallization temperature.
Crystallizati n temperatur s f r**